



Carolina Skies

National Weather Service, Wilmington, NC

Fall 2002

Quiet Hurricane Season for the East

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Nor'easters – Winter's Answer to the Hurricane

Extra-tropical areas of low pressure are similar to their tropical cousins in that winds rotate around them in a counterclockwise fashion in the Northern Hemisphere. However, extra-tropical lows form in a much different manner. Typically, they form in environments that are baroclinic, which is a word meteorologists use to describe an atmosphere with moderate to large temperature differences and lots of wind shear. A cold front is an example of a baroclinic feature. Tropical cyclones typically form in environments that are barotropic, which is an atmosphere with small temperature differences and little or no wind shear.

Extra-tropical lows that trek off the U.S. East Coast are called Nor'easters due to the persistent northeast winds they generate. In addition to wind, these storms often dump copious amounts of rain, snow, and mixed precipitation along the eastern seaboard from Maine to the Carolinas. They also are able to churn up the ocean and result in beach erosion and coastal flooding.

In a typical year, about two dozen of these storms occur off the U.S. East Coast. On average, two or three Nor'easters will become very strong while the rest are of weak to moderate intensity. The amount of precipitation, strength of the wind, and height of the seas varies by the strength of the storm. Since Nor'easters cover a much larger area than hurricanes, most of the beach erosion and coastal flooding that occurs along the eastern seaboard are caused by Nor'easters. In fact, a strong Nor'easter is capable of producing MORE damage than most hurricanes, especially when accompanied by heavy snow, sleet, and freezing rain.

The strongest Nor'easters tend to form after a strong cold front brings cold and dry air off the coast to interact with the waters of the Gulf Stream. This results in a strong baroclinic zone along the eastern seaboard. This baroclinic zone is closest to land off the Carolinas and southern Virginia, since the Gulf Stream is closest to land in this area. As a result, this region is the birthplace of most strong Nor'easters that affect the U.S. East Coast. Typically, Nor'easters strengthen the most north of Cape Lookout. However, they occasionally strengthen off the South Carolina coast and produce wintry weather in the Carolinas.

As we enter this winter season, people in southeast North Carolina and northeast South Carolina should keep these storms in mind. A Nor'easter

in January 2000 dumped five to eight inches of snow over southeast North Carolina. Another in March of 1993 brought significant coastal flooding and heavy snow to much of the U.S. East Coast. If the National Weather Service issues a winter weather or coastal flood warning this winter season, heed the advice given in the warning.

WFO Wilmington Holds 2nd Carolina Marine Advisory Committee Meeting

On October 2, 2002, the National Weather Service in Wilmington held a second Carolina Marine Advisory Committee (CMAC) meeting at the Myrtle Beach Yacht Club in Little River, South Carolina. Fifteen people attended the meeting including Stephanie Fauver, Marine Program Leader WFO Charleston, South Carolina.

CMAC is comprised of diverse group of individuals who represent the local marine community. The committee was established to enhance WFO Wilmington's marine weather program by providing the NWS with valuable feedback related to the needs of the marine

community. CMAC plays a direct role in defining local NWS policies and guidelines.

Andy Shepard, Assoc. Dir., National Undersea Research Center presented information about an observational network that will be deployed off the North and South Carolina coasts. In particular, he discussed bottom mount moorings that will record a plethora of wave and current information. There are stations that are already deployed; however, real-time telemetry has yet to be installed. Eventually the data from these stations will be available on the internet. For the NWS's Marine Forecasters these observations will be very beneficially, especially for a Coastal Waters Forecast area which currently has no marine observations.

There were several agenda items covered during the meeting. Some items dealt with local policy issues which will help the NWS better define the usage of "headline" in the marine forecast and the criteria for the Small Craft Should Exercise Caution advisory. The Shallotte River Power Squadron cited that the coastal waters off the Brunswick County coast behaved much differently than the waters southeast and east of Cape Fear. As a result they recommended utilizing Cape Fear as a break point in the Coastal Waters Forecast more

frequently, especially when there is an offshore wind.

Another discussion focused on adding detail to the wave forecasts. In particular, it was stated that the NWS should include wind and swell wave periods in the forecast since it presents the boater with a better picture of the forecast conditions. The ideas and feedback we have received from CMAC have already helped steer us in the right direction. We would like to thank CMAC for helping make WFO Wilmington's Marine Program one of the best along the East Coast.

The Drought, La Nina, and El Nino

Drought conditions developed across the Carolinas from late 1998 into summer 2002, although during that period the rains of Hurricane Floyd and other tropical cyclones of 1999 increased the water supply in Eastern NC and Northeast SC for many months. Drought conditions were most intense from late 2001 into summer 2002, when the drought was rated on the Palmer Drought Index as severe-to-extreme.

During late summer 2002 and continuing into autumn, decaying tropical cyclones from the Gulf of Mexico and Atlantic-related disturbances caused near-normal rainfall which helped replenish surface water. However, the

deep water table continued depleted.

A drought is a natural, recurring phenomenon when a long-term rainfall deficit leads to less surface water in rivers and reservoirs, as well as less soil moisture and a lowered ground water table.

It has been found that drought in the Carolinas is usually associated with Pacific Ocean temperatures cooler than normal. This is called La Nina...and La Nina was the condition since late 1998 until the summer of 2002. During a La Nina, the subtropical jetstream, or the belt of stronger wind that carries moisture from the tropics to higher latitudes, is weak, and with less moisture available we got less rain.

The NWS Climate Prediction Center, which does long-term temperature and precipitation forecasting through the next 12 months, expects above-average rains this winter to further alleviate drought conditions. They are able to predict long-term above or below-normal rainfall based largely on the Pacific Ocean El Nino / La Nina condition. During an El Niño event, the southern states tend to be wetter, while the northern tier states tend to be warmer and the western states drier. The El Nino this winter will be not be especially strong, but it will be enough to get us wet.

It all has to do with ocean temperature. The oceans cover about 75% of the earth and much of that is the Pacific. The top three meters (ten feet) of an ocean store as much energy as the entire atmosphere. The oceans are heat reservoirs on our planet, and are the main influences on long term atmospheric flow. A small change in ocean temperature distribution has a dramatic effect on air flow in the atmosphere. El Niño is an example.

What is El Niño? Most of the year, anchovy fishermen on the coast of Peru and Ecuador enjoy a bountiful catch from the cold Pacific ocean water that upwells from the depths. However, almost every winter around Christmas time, warmer surface water from out at sea spreads to the coast and the anchovies disappear. Because it happened near Christmas, the fishermen called the warming El Niño, the boy child, named for Jesus. However, some years the El Nino was warmer and lasted longer, with heavy, flooding rains.

Another Pacific phenomenon, the Southern Oscillation, was discovered in the 1920s. The Southern Oscillation Index (SOI) measures the air pressure difference between Tahiti, in the middle of the South Pacific, and Darwin Australia on the Western edge of the

Pacific, near Indonesia. It was found that the warmer the ocean, the lower the air pressure.

It was found that every two to seven years, as the warm water over the equatorial Pacific changes its position, the E-to-W Pacific equatorial trade winds increase/decrease as high pressure over Tahiti strengthens/weakens and corresponding lower pressure over Darwin falls/rises with a corresponding increase/decrease in rainfall over the West Pacific.

The association between El Nino and the SOI was discovered in the 1960s. The terms were combined into ENSO (El Niño/Southern Oscillation). When the Central and Eastern Pacific Ocean is abnormally warm, the trade winds are lighter, and we call that El Nino. When the Central Pacific Ocean is cool, the trade winds are stronger, and we call that La Nina.

So, the term El Niño originated with the anchovy fishermen of Peru and Ecuador, but it was loosely borrowed to describe Pacific Ocean warming thousands of miles offshore. The opposite, La Nina, means "girl child".

Areas of warmer Pacific Ocean water behave like a thermal boulder in the atmosphere because, as a real boulder alters the flow in a river, a huge dome of warm

air over the warm ocean rearranges the way the atmosphere flows as it meanders across the Pacific and the Americas and onto the rest of the world. During an ENSO event, the subtropical jetstream carries tropical moisture across the Carolinas for more rain...and that is what we expect this winter.

Marine Prediction Center Forecaster Coming to WFO Wilmington

A forecaster from the Marine Prediction Center (MPC) will be spending a week at WFO Wilmington this fall as part of a marine forecaster exchange program. In return, WFO Wilmington will be sending Forecaster Ron Steve during the end of October to spend a week training with forecasters at the MPC. Ron will work directly with the MPC forecasters by preparing offshore waters and high seas forecasts. Likewise, the MPC forecaster will work with WFO Wilmington staff by preparing the coastal waters forecast out to 20 nm.

This exchange program has existed for a few years with the intent of familiarizing marine forecasters from the NWS field offices and the MPC with each others operations and techniques. This program is vital since the MPC and NWS field offices collaborate

on marine forecast issues every day. It is essential that MPC forecasters and NWS field office forecasters know the roles and capabilities of each organization.

The Marine Prediction Center, located in Silver Springs, Maryland is responsible for issuing the offshore and high seas forecasts beyond 20 nm of the coastline. They issue Gale and Storm Warnings and work directly with the National Hurricane Center in Miami when a tropical cyclone threatens the western Atlantic. NWS coastal field offices are responsible for issuing marine forecasts and related advisories out to 20 nm. The NWS offices are also responsible for issuing short fuse Special Marine Warnings and Marine Weather Statements for waterspouts, severe thunderstorms, or any potentially hazardous weather phenomenon.

Hurricane Season 2002 and El Nino

El Ninos normally suppress hurricane activity, and weak to moderate El Nino (warm) conditions in the Pacific, as well as a fairly cool Atlantic contributed to slightly below normal Atlantic tropical cyclone activity with fewer hurricanes(only 3) than normal(6), but more tropical storms(12) than normal(10). Before a tropical cyclone

reaches hurricane strength (74 mph), it is named as a tropical storm when the wind speed in the storm reaches 39 mph.

While hurricane season begins on June 1, the first tropical storm, Arthur, was not named until mid-July as it passed by Cape Lookout NC and headed out to sea, with no effect to the area. Bertha did not form until August 4 as a tropical storm that moved across the Gulf of Mexico from near New Orleans to Brownsville TX. Cristobal formed north of the Bahamas and stayed a tropical storm as it moved northeast into the central Atlantic. Dolly was the last tropical storm to form in August - it formed and weakened in the central tropical Atlantic.

September normally is more active, as atmospheric Cape Verde waves from Africa cross the Atlantic toward the U.S. coast. This year the African waves were weak. On September 1, Edouard formed off the Florida Atlantic coast and crossed into the Gulf of Mexico before moving ashore on the Gulf Coast. Fay formed off the Texas coast and moved ashore with heavy rains. Gustav formed about 500 miles southeast of Cape Fear NC and a Tropical Storm Warning was raised for the NC coast on Sep 8. Gustav brushed the NC Outer Banks on the 9th with tropical storm-force winds, while SE NC had

gusts only as high as 30 mph and around one inch of rain. Rough surf likely contributed to the death of a swimmer at Myrtle Beach. As Gustav headed toward the Canada Maritime Provinces, it strengthened into the first hurricane of the season on Sep 11, a Category 1 storm with wind around 90 mph. Hannah formed in the Gulf of Mexico on Sep 13, moved ashore between New Orleans and Mobile on the 14th, and moved inland with around a half-foot of rain on the western Carolinas and nearly two inches in the coastal counties through the 15th.

Isidore formed from an African wave, hit Cuba as a Category 2 hurricane on the 20th, and reached Category 3 strength on the 21st. It weakened over the Northern Yucatan Peninsula, then moved into the Gulf of Mexico as a Tropical Storm and made landfall on the Louisiana Coast on the 26th. Josephine, a weak tropical storm, formed on the 18th in the central Atlantic, where it weakened.

Kyle was the 3rd longest-lived tropical cyclone in history. Kyle formed on Sep 21st in the Central Atlantic and moved erratically toward the U.S. coast, and a Tropical Storm Warning was raised for the Carolina Coast on Oct 10. Approaching Charleston, Kyle turned NE and ran up the coast before weakening near

Cape Fear on the 11th, when the warning was lowered. A tornado occurred in Georgetown and there was street flooding in Williamsburg and Georgetown Counties. There were gusts 40 to 50 mph reported on the Carolina coast as far north as the Cape Fear area.

Lili, the last tropical cyclone as of this writing, formed on Sep 23 near the Windward Islands and passed Cuba on Oct 1 as a Category 2 hurricane. By October 2, Lili had Category 4 strength with wind near 145 mph as it bore down on the Louisiana coast. Lili weakened to Category 1 strength just before making landfall, and the remnants moved up the Mississippi valley.

Hazardous Weather Outlook

While weather may be fascinating, most busy people do not have time for it unless they expect to get hit. For instance, a hurricane becomes much more important when it is headed our way.

The Hazardous Weather Outlook is issued daily to answer the question, "What do I need to worry about?", for the next 7 days. Short and to the point, it distills from the forecast for the next week only the expected hazards. Hazards include any weather that would cause the NWS to issue non-routine products for

severe thunderstorms, tornadoes, flooding, high wind, heat, fog, winter weather, coastal flooding, etc.

The Hazardous Weather Outlook is not broadcast on the NOAA Weather Radio, but it is available fresh every morning on our webpage: <http://www.erh.noaa.gov/ilm>.

Just click on "Hazardous Outlook" in the left margin.

Winter is Coming!

With El Nino conditions expected, it looks like this winter could be wetter than normal. Snow, sleet, and freezing rain are precipitation hazards that prompt Advisories and Warnings. Here are the criteria:

1. **A Winter Weather Advisory will be issued for snow or sleet expected to accumulate an average depth of one inch in a county, or for any freezing rain event.**
2. **A Winter Weather Warning will be issued for snow or sleet expected to accumulate an average depth of two or more inches in a county, or for freezing rain expected to accumulate at least one quarter inch.**

The Climate Corner

The Eastern Carolinas experienced above normal temperatures overall for the months of July, August, and September. Region wide, temperatures averaged .5 degrees to 2.3 degrees above normal for the period. Interior sections experienced the warmest temperatures with temperatures averaging 0.8 to 2.3 degrees above normal for the period. Coastal areas saw temperatures averaging .5 to 1.5 degrees above normal for the same period. No sustained heat spells were noted across the area for the period. Lumberton and Florence both hit the century mark twice in July. In August, Florence reached the century mark twice with a max high temperature of 103 degrees, and Lumberton reached the century on one day when the temperature topped out at 102 degrees. But the extreme highest temperatures recorded for the period occurred in late July at Cades and Conway South Carolina, with each cooperative station topping out at a whopping 105 degrees. High temperatures along the immediate coast never reached the century mark for the period.

Precipitation across the Eastern Carolinas was slightly above normal for the months of July, August and September, thanks to a very

wet August. Inland areas continued to experience below normal rainfall with averages .26 to .71 inches below normal for the period. Coastal areas experienced above normal rainfall with averages .23 to 1.04 inches above normal for the period. Rainfall in July was slightly below normal area wide, but rainfall totals across the area rebounded in August, with precipitation averages ranging from .16 above normal at Lumberton, to nearly 5 (4.78) inches above normal in Wilmington. In fact, Wilmington received over 12 inches of rain (12.09) in August, with 8.77 inches of that coming in the last four days of the month. September saw a return to below normal precipitation with averages ranging 1.04 to 2.62 inches below normal, despite the passing of a couple of Tropical Storms just offshore.

NC Improves Flood Maps and NWS Improves Flood Forecasting

The 1990s saw an increase in landfalling hurricanes along the East Coast of the United States, in particular, the state of North Carolina. As a result of these powerful storms, the state has had 14 federally declared disasters since 1989. All these disasters have resounded the need for updated flood maps in the state of North Carolina. In

fact, 80 percent of all homes damaged by Hurricane Floyd in 1999 were not depicted in a flood hazard zone as referenced by the flood maps valid at the time of the event.

In the year 2000, North Carolina established the Flood plain Mapping Program to generate new, accurate and detailed Flood Insurance Rate Maps. Elevation data was collected for the six easternmost river basins in the state with a vertical accuracy of 20-25 centimeters to bare earth.

Flood plain maps have been completed over the Tar-Pamlico River Basin and are set to be completed over the Lumber and Cape Fear River Basins by November 2003.

With the goal of savings lives and property by providing the best flood and river flood warnings to the public, the National Weather Service has partnered with the state of North Carolina in this flood plain mapping effort. In 2002, the National Weather Service and parent organization the National Oceanic and Atmospheric Administration, through a congressional earmark, provided funding to the state of North Carolina to initiate and establish a flood warning application utilizing the state-of-the-art flood plain maps. These improved flood forecasts are a part of the National Weather Service's

Advanced Hydrologic Prediction Services.

What this means for the community and emergency official is the possibility of running real-time flood inundation scenarios using National Weather Service forecasts and new flood plain maps. Applications for the new maps are still being developed as representatives from the North Carolina Flood plain Mapping Program and the National Weather Service visit local emergency personnel and city and county planners to determine their needs. Great advances are in the works.

To learn more about the North Carolina Flood plain Mapping Program, visit their web site at <http://www.ncfloodmaps.com>

For information on the National Weather Service's improved flood warning systems visit the following web site:

<http://www.srh.noaa.gov/serfc/ahps/RVFNC.htm>

Columbus and Georgetown Counties join the StormReady Community

Ninety percent of presidential disaster declarations are weather related, and county emergency managers are working with

the National Weather Service to prepare for dangerous weather. This fall, Columbus and Georgetown Counties were recognized as StormReady.

In our area, Robeson, Dillon, Pender, Brunswick, Horry and Columbus, Georgetown, and New Hanover Counties have been formally recognized for meeting the StormReady requirements, and applications are being considered for more.

Nationwide, about 500 counties and communities have been recognized as StormReady.

StormReady requirements include:

- 1. 24 hour communications capability and an Emergency Operations Center**
- 2. Multiple means of receiving NWS warnings**
- 3. Local weather monitoring capability, storm spotter training**
- 4. Warning dissemination - weather radios in public buildings, schools, etc.; TV overrides**
- 5. Public preparedness campaigns, safety talks**
- 6. Administrative - A Hazardous Weather action plan and drills to test plan**

The StormReady program is a guide for counties to prepare and stay prepared - recognition is for three years, and must then be renewed. For more information on the

program, call Tom Matheson at 910-762-8043 or see this website:

<http://www.nws.noaa.gov/stormready/>

Folklore Winterization

Our ancestors survived by their ability to cope with nature-without the artificial barriers we have since erected. While they may not always have been right, they were not fools either, and their conclusions deserve a thorough hearing. Here are a couple of animal indicators of seasonal weather that experts have rejected entirely. We present them to you because we are not sure they are meaningless. The first dates back to the 1730's; the second is thought to be both an American Indian and a European origin:

Observe which way the hedgehog builds her nest,

To front the north or south, or east or west,

For it's true what common people say,

The wind will blow the quite contrary way.

and

When the swallow's nest is high

The summer is very dry;

When the swallow buildeth low

You can safely reap and sow.